Result Page

The present invention relates to a process of dimensional check of a matter cord deposited on a surface, as well as a device for such a dimensional check.

The deposit of a joint of < RTI ID=1.1> matiére< /RTI> is a fundamental industrial process used in many technical fields.

The invention will be described as nonrestrictive example in relation to the deposit of a cord of adhesive on the surface of a sheet, such as that is practised in the car industry, given that that the invention can be generalized and extended to the control of the deposit of a pasty or pulverulent matter unspecified on a support of any nature.

In the example chosen like context for the description of the invention, one seeks a device which is able to carry out the check dimensional of a cord of adhesive, extruded section by a tube and posed on a sheet carried by a robot. The tube is for example fixed, and the sheet is mobile compared to the tube according to a three-dimensional trajectory. Such an inspecting device of cord of adhesive is in particular useful at the time of the deposit of a cord of adhesive on an element of body of motor vehicle.

One knows already in the state of the art, of the inspecting devices of a cord of adhesive. Such a device is described in patent FRA 2.703.784 of the same applicant. This device is able to indicate if the cord of adhesive controlled is continuous, but it does not give information on the position of the cord on the support, nor on the diameter of the cord. Moreover, the known inspecting device is of a limited use, since it is mobile around the tube of deposit of adhesive, and cannot function in partnership with a fixed housing which deposits a cord of adhesive on a mobile sheet.

So the purpose of I' invention is in particular to propose a device and a process of dimensional check of a cord of adhesive, making it possible to control the position and the diameter of an extruded cord of adhesive by a fixed housing which deposits the cord on a mobile sheet related by a robot to a three-dimensional trajectory.

The purpose of the invention is also to propose a device and a process ready to act as real time so as to as soon as possible present at an operator the images possible defects of quality, and in any case as of the end of the cycle of deposit of a cord by a robot.

More precisely, the required device must in particular be able to detect, by order of gravity < RTI ID=2.1> décroissante< /RTI>
- interruptions of the cord of adhesive having a length higher than the diameter of the < RTI ID=2.2> cordon< /RTI>
- lacks of adhesive at the beginning or the end of the deposit of < RTI ID=2.3> colle< /RTI>
- defects of position of the adhesive compared to sheet, in particular at the beginning of deposit, and compared to a deposit of < RTI ID=2.4> référence< /RTI>
- variations of diameter of the cord of adhesive of a percentage predetermined in more or less, for example 5%, compared to the diameter of a deposit of reference.

For this purpose, I' invention relates to a dimensional inspecting device of a matter cord deposited on a support, in particular of a cord of adhesive deposited on a sheet, the cord of matter being provided by a tube and the mobile support compared to the tube according to a three-dimensional trajectory, being characterized in that it comprises:
- means of lighting ready to clarify a zone in the vicinity of the part of the matter cord in the course of < RTI ID=2.5> dépôt< /RTI>
- at least a camera to record the images of the cord during the operation of deposit
- means of image processing to treat the images recorded by the camera, and to deduce from it information from quality control of the operation of deposit of the matter cord.

According to other characteristics of the inspecting device according to the invention:
- it comprises means of memory to record the images of the defects of deposit, and means of digitalization and analysis of the images thus < RTI ID=3.1> mémorisées< /RTI>
- preferably, the means of memory include/understand a fast memory, type video report VRAM with double access, and the means of digitalization and analysis are consisted a processor connected to the means of memory by a video bus < RTI ID=3.2> rapide< /RTI>
- the means of lighting comprise a lighting in halogenous light, and are placed so as to emit a directed beam in a way appreciably parallel with the camera
- the camera and the means of lighting are fixed on the tube close to its end, in order to obtain an image of large < RTI ID=3.3> taille< /RTI>
- the processor of digitalization and analysis of images functions at a rate higher or equal to the rate of frame grabbing, in order to analyze the images in real time.

- advantageously, the device comprises means of visualization of the analyzed images, in the shape of a screen

connected to the means of digitalization and analysis of the images.

The invention also relates to a process of dimensional check of the deposit of a matter cord on a support, in particular of a cord of adhesive on a sheet, the cord of adhesive being provided by a tube and the mobile support compared to the tube according to a three-dimensional trajectory, being characterized in that it comprises of the stages consisting < RTI ID=4.1> à< /RTI>
- to carry out a machine learning of the position and diameter of a cord of < RTI ID=4.2> référence< /RTI>
- to determine the position and the diameter currents of the matter cord in the course of < RTI ID=4.3> dépôt< /RTI>
- to compare in an automatic way the position and the diameter currents with the corresponding values of reference, and the result, to indicate if the position and the diameter of the current cord are acceptable.

According to other characteristics of the process of control:
- to determine the position of the cord running compared to the cord of reference, one determines the distance between the median of the cord of reference and the median of the cord running, in a plurality of successive transverse plans of the cord in the direction of formation of < RTI ID=4.4> that-ci< /RTI>
- to determine the diameter of the current cord, one determines his transverse limits using levels of gray, the passage on the cord corresponding to a rising face of a signal representative of the level of gray, and the passage to leave the cord corresponding to a downward face of the signal representative of the level of gray, the current diameter of the cord being consisted the distance between the face going up and the downward face.

▲ top The invention will be included/understood better while referring to made following description as nonrestrictive example and to the Ci-annexed drawings, in < RTI ID=4.5> lesquels< /RTI>
- figure 1 represents in a diagrammatic way the elements of the inspecting device according to the invention;
- figure 2 represents the structure of < RTI ID=5.1> ia< /RTI> memory used in the device of figure 1, in correspondence with stages of the process of < RTI ID=5.2> contrôle< /RTI>
- figure 3 represents the useful parameters during the phase of training of the process according to the invention;
- figure 4 represents the useful parameters during the automatic phase of check of the process according to the invention;
- figure 5 represents a functional flow chart of the stages of the process of control according to the invention.

One refers on figure 1. One represented on this figure a general diagram of the inspecting device 1 according to the invention. Device 1 is associated a tube of known extrusion 2 by oneself, allowing the extrusion of a matter 3 cord, which is for example a cord of adhesive to be deposited on a support like a sheet 5. The inspecting device 1 comprises means of lighting 6 directed towards the cord of adhesive 3 to control, a camera 7 also directed towards cord 3 in the course of deposit, and intended to record uninterrupted the images of the deposit, the means of treatment 8 of the images of the camera 7, and a display screen 9 intended to represent for an operator an increased image of the cord deposited 3.

The means of lighting 6 are preferably consisted by a halogenous lamp whose beam is directed towards cord 3, and of sufficient power so that the enlightened zone is not disturbed by ambient lighting in the workshop.

Camera 7 is in particular consisted a camera
CCC black and white filming the cord of adhesive 3 deposited on sheet 5 Juste after extrusion by tube 2. Camera 7 and the means of lighting 6 preferably appreciably coaxial and are directed towards cord 3, and are fixed on the body of tube 2 near the end of this one, via a common support 10. Thus it is possible not only to obtain a precise image and of big size of cord 3, but also an image deprived of parasitic vibrations, since the movements of camera 7 and tube 2 are coordinated.

The device of image processing 8 is a device comprising a stage of acquisition/digitalization of images connected on a floor of analysis of the images, these stages being carried out by known electronic circuits in oneself, which will not be detailed within the framework of this description.

Preferably, the images provided by camera 7 are analyzed at video rate, which supposes that the processing time of the images is lower than their time of acquisition,
Analysis of the images being done in time masked compared to the time of acquisition, so that the inspecting device 1 does not lengthen the industrial cycle of deposit of adhesive.

According to the invention, the means of analysis 8 comprise means of memory 11 (figure 2) to safeguard the images of the defects of cord 3 which are localised during the deposit, these means of memory 11 being organized to allow the analysis of the images without increasing the cycle time of the deposit of adhesive.

The memorized images are visualized either simultaneously, or later on with the realization of cord 3.

Ultimately, it is the operator who within sight of the defects raised on the screen, decides to validate a deposit of cord or to refuse it.

One refers on figure 2, where is represented in a diagrammatic way the structure of memory 11 of the means of treatment, being used to memorize the digitized images of the cord.

The image processing at video rate is made possible by the use of a video memory of type VRAM to double access. This one allows on the one hand the frame grabbing number N in a storage area < RTI ID=7.1> M1< /RTI> and in addition, simultaneously, treatment by the processor of the image number < RTI ID=7.2> n-l< /RTI> who is stored in a storage area m2, as represented in figure 2A. Then the image number < RTI ID=7.3> n+l< /RTI> is digitized in m2 while the processor reaches in < RTI ID=7.4> M1< /RTI> with image N, as represented in figure 2B.

A bus of video transfer 12 high performance ensures the communication of memory VRAM towards the processor. The processing time of a given image is thus limited to one duration lower than the time of frame grabbing, about 40 ms for example. Device 1 thus makes it possible to control 25 images a second in this case of figure, i.e. it functions in video real time. When a defect is detected on image N, I' frame grabbing number n+2 is shifted in the zone memory m3, as represented in figure 2C. At the end of the cycle, it is possible to visualize the image number N again.

One refers on figures 3 and 4 to explain the stages of the process according to the invention.

The implementation of device 1 is done according to a process in two principal stages: a phase of training (figure 3) and an automatic phase of check (figure 4).

The phase of training requires of the operator to validate on a plurality of images of a sequence of images, the position of median 13 of the cord. Preferably, < RTI ID=7.5> I' ensemble< /RTI> sequence of deposit of adhesive of the phase of training is recorded in memory, in order to be able to be revisualisée at will.

As indicated of figure 3, cord 3 extruded section by tube 2 moves in a radial way compared to tube 2.
The training will consist in giving on each image the position of cord 3 symbolized by median 13 of the cord.

Let us consider the treated image number N. One indicates by < RTI ID=8.1> C1< /RTI> and
C2 circles centered on the tube 2, on which one seeks the presence of the cord of adhesive 3. One indicates per annum and < RTI ID=8.2> Bn< /RTI> points of intersection of the median segment 13 of the cord with the circles < RTI ID=8.3> C1< /RTI> and C2.

The co-ordinates Year and Bn of the ends of the median of the cord are stored in memory. The system typically treats the image number N in a time of about 40 ms at the maximum. On the following image, i.e. the image number < RTI ID=8.4> n+l, < /RTI> the points < RTI ID=8.5> An+1< /RTI> and < RTI ID=8.6> Bn+1< /RTI> will be deduced from the An points and < RTI ID=8.7> Bn< /RTI> precedents by a mechanism of continuation gradually. The phase of training requires only the knowledge of the initial position of the cord, symbolized by the points < RTI ID=8.8> Ao< /RTI> and < RTI ID=8.9> Bo.< /RTI>

To the exit of this training, device 1 will calculate the diameters and positions of cord 3 (figure 3) on each image, thus constituting the measures of reference. Thereafter, each new analyzed cord will be compared with these measurements of reference.

The second phase of the process is an automatic phase of check during each cycle of industrial deposit of cord of adhesive 3. It gives uninterrupted the diameters and the positions of cord 3 during each operation of deposit.

Let us consider the treated image number N (see figure 4). The points Year and Bn are provided by the phase of training as described above, then the orthogonal successive Pj profiles with the segment [Year, Bn] are positioned.

According to the invention, I' algorithm of control makes it possible to determine the higher edges B2j and lower < RTI ID=8.10> B2i+, < /RTI> cord 3, in spite of the possible presence of reflections on sheet and/or the < RTI ID=9.1> cordon.< /RTI>

In practice, one uses for this phase of the process, the various levels of gray corresponding to the absence or the presence of the cord. By considering the levels of gray on the Pj segment, the edge < RTI ID=9.2> B2< /RTI> corresponds to a rising face and the edge < RTI ID=9.3> B2i+l< /RTI> with a downward face of a signal representative of the levels of gray. On each Pj profile, two rising faces and two downward faces are given. Detected cord 3 corresponds to the pairing of a rising face and a downward face. The diameter of the cord is then defined as being the distance between the two faces. The position of cord 3 in the image is given for example by the position of the face going up compared to the median of the cord of reference. Thus, erroneous detections, due to effects sheet edge or to reflections, are eliminated.

From the points < RTI ID=9.4> B2< /RTI> and B2i+, representing the position of the edges of cord 3, one compare the values obtained with those of the cord of reference safeguarded at the time of the phase of training described above. Possible defects of position or drifts of cord 3 are thus characterized.

The image corresponding to the defect is preferably safeguarded in memory during the normal continuation of the treatment until the end of the operation of deposit.

Famous figure 5 in a way diagrammatic unfolding of an algorithm implementing and summarizing the two principal phases of the process, namely the phase of training, represented of 14, and the phase of analysis, represented into 15. One represented in the 16 and 17 actions of the operator corresponding to each respective phase 14,15 of the process. < RTI ID=9.5> II< /RTI> is necessary to note that algorithm (block 15) is preferably designed to publish a report/ratio of control in the event of detection of a defect, to give the dimensional specifications in particular of them. The information of detection of defect is used by the operator to judge if it is necessary to validate or reject the part on which device 1 works.

Moreover, during the adjustment of the parameters (block 14), an absolute reference of the position of the cord compared to a reference mark on sheet is used to gauge the whole of device 1, as well during the phase of training as during each cycle of deposit of cord of adhesive.

The device and the process according to the invention make it possible to achieve the fixed goals, and comprise many advantages. The inspecting device has a great robustness of detection, even in the presence of a nonuniform lighting for a given image, or of a variable lighting from one image to another during the deposit. < RTI ID=10.1> II< /RTI> allows to calculate up to ten diameters of adhesive per image and thus ensures a control of the diameter of adhesive every 2 mm during the deposit (by considering for example the parameters of the device figure 1 describes).

CLAIMS

1. Device (1) of dimensional check of a matter cord (3) deposited on a support (5), in particular of a cord of adhesive deposited on a sheet, the cord of matter (3) being provided by a tube (2) and the support (5) mobile compared to the tube (2) according to a three-dimensional trajectory, being characterized in that it < RTI ID=11.1> comporte< /RTI>
- means of lighting (6) ready to clarify a zone in the vicinity of the part of the matter cord (3) in the course of < RTI ID=11.2> dépôt< /RTI>
- at least a camera (7) to record the images of the cord (3) during the operation of deposit
- means of image processing (8) to treat the images recorded by the camera (7), and to deduce from it information from

quality control of the operation of deposit of the matter cord (3).

2. Device < RTI ID=11.3> (I) < /RTI> according to claim 1, characterized in that the means of image processing (8) comprise means of memory (11) to record the images of the defects of deposit, and means of digitalization and analysis of the images thus memorized.

3. Device < RTI ID=11.4> (1) < /RTI> according to claim 2, characterized in that the means of memory (11) include/understand a fast memory, type video report VRAM with double access, and in what the means of digitalization and analysis are consisted a processor connected to the means of memory (11) by a fast video bus (12).

4. Device < RTI ID=11.5> (I) < /RTI> according to any of the preceding claims, characterized in that the means of lighting (6) comprise a lighting in halogenous light,